

ABSTRACT:

The present invention includes a delivery means of material to be deposited onto thin film surfaces with precise spatial, temporal, compositional, and energy resolution for controlled reactions, patterning (2-dimensional and 3-dimensional), and removal of materials or reaction products of materials from thin film surfaces. The device includes a near atmospheric pressure means of generating ions, ion clusters, or charged particles as a material form to deliver said materials onto substrate surfaces. The device relies on shaped, patterned, conformal ion lenses, and individually addressable lens elements of a lens arrays to create an integrated deposition system for printed patterns of thin films. The devices and methods provide a novel approach to delivering materials to a surface, removing materials from a surface, or creating new materials at or on the surface. These methods and devices may be used in applications of thin film deposition, micro-electronics and semi-conductor manufacturing, printing, surface interfacial layers, coating, painting, sample and reagent treatment, preparation for sensors, chemical analysis, and fabricating 2- and 3-dimensional structures and devices.